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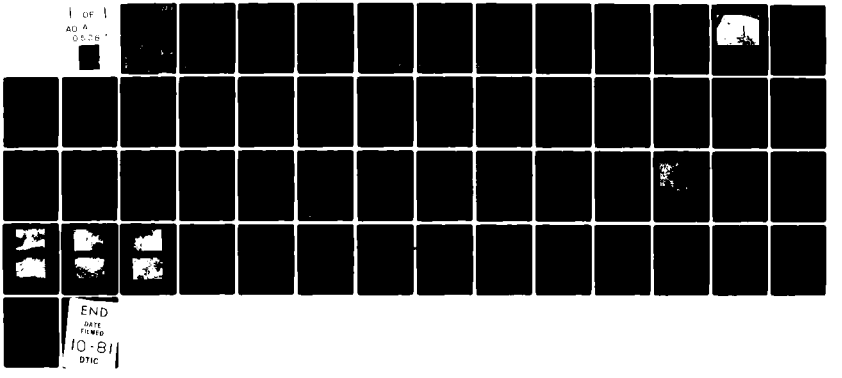

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POTOSI LAKE DAM
WASHINGTON COUNTY, MISSOURI
MO 30477

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

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SEPTEMBER 1980

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	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Woodward-Clyde Consultants	8. CONTRACT OR GRANT NUMBER(s) DACW43-80-C-0066
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
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National Dam Safety Inspection. Potosi Lake Dam (MO 30477), Mississippi - Kaskaskia - St. Louis Basin, Washington County, Missouri. Phase I Inspection Report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 TUCKER BOULEVARD, NORTH
ST. LOUIS, MISSOURI 63101

REPLY TO ATTENTION OF

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SUBJECT: Potosi Lake Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Potosi Lake Dam (MO 30477).

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, emergency by the St Louis District as a result of the application of the following criteria:

a. Spillway will not pass a 10-year frequency flood without overtopping of the dam. The spillway is, therefore, considered to be unusually small and seriously inadequate.

b. Overtopping could result in dam failure.

c. Dam failure significantly increases the hazard to life and property downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division

1 DEC 1980
Date

APPROVED BY:
Colonel, CE, District Engineer

1 DEC 1980
Date

POTOSI LAKE DAM

Washington County, Missouri

Missouri Inventory No. 30477

Phase I Inspection Report

National Dam Safety Program

Prepared by

Woodward-Clyde Consultants

Chicago, Illinois

Under Direction of

St Louis District, Corps of Engineers

for

Governor of Missouri

September 1980

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams for Phase I Investigations. Copies of these guidelines may be obtained from the Office of the Chief of Engineers, Washington, D. C., 20314. The purpose of a Phase I investigation is not to provide a complete evaluation of the safety of the structure nor to provide a guarantee on its future integrity. Rather the purpose of the program is to identify potentially hazardous conditions to the extent they can be identified by a visual examination. The assessment of the general condition of the dam is based upon available data (if any) and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify the need for more detailed studies. In view of the limited nature of the Phase I studies no assurance can be given that all deficiencies have been identified.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with any data which may be available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action removes the normal load on the structure, as well as the reservoir head along with seepage pressures, and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected, so that corrective action can be taken. Likewise continued care and maintenance are necessary to minimize the possibility of development of unsafe conditions.

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam	Potosi Lake Dam
State Located	Missouri
County Located	Washington
Stream	Unnamed Tributary of Big River
Date of Inspection	25 June 1980

Potosi Lake Dam, Missouri Inventory Number 30477, was inspected by Mr L. M. Krayzynski (geotechnical engineer), Mr R. Juyal (hydrologist) and Mr J. B. Stevens (geotechnical engineer). The dam is an earth dam used for recreational purposes.

The dam inspection was made following the guidelines presented in the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of federal and state agencies, professional engineering organizations, and private engineers. The resulting guidelines represent a consensus of the engineering profession. They are intended to provide an expeditious identification, based on available data and a visual inspection, of those dams which may pose hazards to human life or property. In view of the limited scope of the study, no assurance can be given that all deficiencies have been identified.

This dam is classified as small due to its 33-ft height and 544 ac-ft storage volume. Dams within the small size classification have heights between 25 and 40 ft or storage capacities between 50 and 1000 ac-ft.

The St Louis District, Corps of Engineers, has classified this dam as high hazard; we concur with this classification. Several occupied structures are located within the estimated damage zone. The zone, as determined by the St Louis District, extends approximately one mile downstream.

The inspection and evaluation indicate that the dam is in generally poor condition. Specific deficiencies that were noted are inadequate spillway capacity, the high potential for spillway blockage, the dense growth of large trees and brush on the downstream slope and along the upstream crest, and lack of maintenance and periodic inspections. Also deemed as a deficiency is the lack of any stability or seepage analyses comparable to the requirements of the guidelines.

Hydrologic/Hydraulic studies indicate that the 10 percent probability-of-occurrence event (10-yr flood) will cause overtopping of the dam. These analyses also indicate that the dam will be overtopped for a hydrologic event which produces greater than eight percent of the Probable Maximum Flood (PMF). The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region.

For this small size dam, it is recommended that the dam crest elevation and spillway be designed to pass the 100 percent PMF event. It appears probable that extensive erosion would take place on the downstream slope of the dam during the PMF, thus endangering the ability of the dam to withhold its greater than 500 ac-ft of storage. The proximity of the residents downstream of the dam and the likelihood of further home development downstream, indicate that the loss of life and property could be high in the event of a dam failure. It is recommended that this design be undertaken immediately.

It is also recommended that the following additional studies, as a minimum, be performed without undue delay:

1. Removal of the trees and brush on the dam slopes. The dam should then be inspected to detect any evidence of slope instability. Removal of large trees should be done under the guidance of an engineer experienced in the design and construction of dams. Indiscriminate clearing of large trees could jeopardize the safety of the dam.

2. Seepage and stability analyses in accordance with the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

It is further recommended that a program of periodic inspections be implemented. The inspections should include but not be limited to monitoring the amount and turbidity of seepage, checking for evidence of slope instability, and monitoring the deterioration of the spillways and siphon. The results of the inspection program should be recommendations for required maintenance, if any. Records should be kept of inspections and maintenance.

All remedial measures should be performed under the guidance of an engineer experienced in the design and construction of earth dams.

WOODWARD-CLYDE CONSULTANTS

Richard G. Berggreen,
Registered Geologist

Leonard M. Krazynski, P.E.
Vice President

OVERVIEW

POTOSI LAKE DAM

MISSOURI INVENTORY NO. 30477

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
POTOSI LAKE DAM - MISSOURI INVENTORY NO. 30477
TABLE OF CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM
POTOSI LAKE DAM, MISSOURI INVENTORY No. 30477

SECTION 1
PROJECT INFORMATION

1.1 General

a. **Authority.** The National Dam Inspection Act, Public Law 92-367, provides for a national inventory and inspection of dams throughout the United States. Pursuant to the above, an inspection was conducted of Potosi Lake Dam, Missouri Inventory Number 30477.

b. **Purpose of inspection.** "The primary purpose of the Phase I investigation program is to identify expeditiously those dams which may pose hazards to human life or property... The Phase I investigation will develop an assessment of the general condition with respect to safety of the project based upon available data and a visual inspection, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted" (Chapter 3, "Recommended Guidelines for Safety Inspection of Dams").

c. **Evaluation criteria.** The criteria used to evaluate the dam were established in the "Recommended Guidelines for Safety Inspection of Dams", Engineering Regulation No. 1110-2-106 and Engineering Circular No. 1110-2-188, "National Program for Inspection of Non-Federal Dams", prepared by the Office of Chief of Engineers, Department of the Army, and "Hydrologic/Hydraulic Standards, Phase I Safety Inspection of Non-Federal Dams", prepared by the St Louis District, Corps of Engineers (SLD). These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 Description of Project

a. **Description of dam and appurtenances.** Potosi Lake Dam is an earth dam constructed for recreational purposes. The main spillway is a 3-ft dia corrugated metal pipe (CMP), or culvert, which discharges into an unlined earth channel. A 2-ft dia CMP serves as the auxilary spillway and discharges into the same channel. A siphon (12-in. dia steel pipe) crosses the dam at about the midpoint. It crosses under the road and rests on the downstream slope. It discharges at the dam toe.

b. **Location.** The dam is on an unnamed tributary of Big River about 7.1 mi southeast of Potosi, Washington CO, Missouri in Sec 35, T37N, R3E. It is about 0.7 mi south of Missouri Highway 8 and is located on the USGS Mineral Point 7.5-minute quadrangle map.

c. **Size classification.** The dam is classified as small due to its 33-ft height and 544 ac-ft storage volume. Dams within the small size classification have heights between 25 and 40 ft or storage capacities between 50 and 1000 ac-ft.

d. **Hazard classification.** The SLD has classified this dam as a high hazard dam; we concur with this classification. The SLD estimated damage zone extends approximately one mile downstream. Several occupied structures are located within this zone.

e. **Ownership.** The dam is reportedly owned by the Potosi Lake Village Association, Rte 1, Mineral Point, MO 63660. Correspondence should be addressed to the attention of Mr William Semet.

f. **Purpose.** The impoundment is used for recreational purposes.

g. **Design and construction history.** According to Mr Semet, there are no design drawings or construction records available for this dam. The dam was constructed in 1947 or 1948. The original spillway was a concrete pipe located at the NE end of the dam. A 24-in. dia galvanized metal culvert (corrugated metal pipe, CMP) was added in 1966 or 1967, NE of the concrete pipe main spillway. In 1970 or 1971, the original main spillway was removed. The spillway was replaced by a 36-in. dia galvanized metal culvert which is approximately 50 ft NE of the original main spillway.

h. **Normal operating procedures.** No operating records were found. Mr Semet stated that the lake level is drawn down about five to eight feet with the siphon each winter so that residents can work on their docks and to allow the frost to kill vegetation. The normal pool elevation is limited by the uncontrolled flow through the spillway.

1.3 Pertinent Data

a. **Drainage area.** Approximately 0.86 mi^2

b. **Discharge at dam site.**

Maximum known flood at damsite	Unknown
Warm water outlet at pool elevation	Not Applicable (N/A)
Diversion tunnel low pool outlet at pool elevation	N/A
Diversion tunnel outlet at pool elevation	N/A
Gated spillway capacity at pool elevation	N/A
Gated spillway capacity at maximum pool elevation	N/A
Ungated spillway capacity at maximum pool elevation	60 ft^3/sec (at el 875.5)
Total spillway capacity at maximum pool elevation	60 ft^3/sec (at el 875.5)

c. **Elevations (ft above MSL).**

Top of dam	875.5 to 878.6
Maximum pool-design surcharge	N/A
Full flood control pool	N/A
Recreation pool	872.0
Spillway crest (gated)	N/A
Upstream portal invert diversion tunnel	N/A
Downstream portal invert diversion tunnel	N/A
Streambed at centerline of dam	Unknown
Maximum tailwater	N/A
Toe of dam at maximum section	842.7

d. **Reservoir.**

Length of maximum pool	1800 ft
Length of recreation pool	1750 ft
Length of flood control pool	N/A

e. **Storage (acre-ft).**

Recreation pool	438
Flood control pool	N/A
Design surcharge	N/A
Top of dam	544

f. **Reservoir surface (acres).**

Top of dam	32
Maximum pool	32
Flood control pool	N/A
Recreation pool	28
Spillway crest	28

g. **Dam.**

Type	Earth fill
Length	500 ft
Height	33 ft
Top width	39 ft
Side slopes	D/S 2.4(H) to 1(V) U/S Unknown
Zoning	Unknown (Probably homogeneous section)
Impervious core	Unknown
Cutoff	Unknown (Probably none)
Grout curtain	Unknown (Probably none)

h. **Diversion and regulating tunnel.**

Type	N/A
Length	N/A
Closure	N/A
Access	N/A
Regulating facilities	N/A

i. **Spillway.**

Type	36- and 24-in. CMP
Length of weir	N/A
Crest elevation	872.0; 873.5, respectively
Gates	N/A
Upstream channel	N/A
Downstream channel	Unlined earth

j. **Regulating outlets.**

12-in. steel pipe siphon requiring manual start. Upstream end elevation is unknown. Downstream end elevation is 845.2 ft.

SECTION 2
ENGINEERING DATA

2.1 Design

No design drawings or reports have been found for this dam.

2.2 Construction

No construction records or data were found.

2.3 Operation

No records were found for maintaining a maximum or minimum pool elevation. The siphon is used each winter to lower the lake five to eight feet so that owners can work on lakeside structures and to permit frost to kill vegetation on the reservoir banks.

There are no records of outflow at the spillway.

2.4 Evaluation

a. **Availability.** No data was available for review.

b. **Adequacy.** Insufficient data were available to determine the adequacy of the design.

Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" are not on record. These analyses should be performed by an engineer experienced in the design and construction of dams. Further, these seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

c. **Vaiidity.** Not applicable.

2.5 Project Geology

The dam site lies on the northern flank of the Ozark structural dome. The regional dip is to the north. The bedrock in the area is mapped as Cambrian age Eminence and Potosi dolomite formations on the Geologic Map of Missouri (Fig 4). The Potosi Formation is a light gray, medium- to fine-grained dolomite and typically contains an abundance of quartz druse characteristic of chert bearing formations. The Eminence Formation conformably overlies the Potosi Formation, is similar in appearance but contains less quartz and chert.

The soil at the dam site is a dark red-brown, plastic residual clay (CH), characteristically developed on the Potosi Formation. It is locally overlain by a one- to five-foot thick silty loess soil (ML). The area is mapped on the Missouri General Soils Map as Union-Goss-Gasconade-Peridge Association.

A northeast trending branch of the Big River Fault System is mapped on the Structural Features Map of Missouri (1979) approximately one mile south of the dam site. The principal fault trace is approximately 24 mi in length, trending northeast-southwest. The fault is mapped as north side down. The Aptus Fault is located approximately 4 mi west of the site, and has a mapped length of approximately 15 mi. The fault trends northwest-southeast and is mapped as northeast side up. The Cabanne fault, an east-west trending fault approximately 11 mi in length, is located approximately 4-1/2 mi north of the site. The fault is mapped as north side down. All of these faults are within Palezoic or older rocks, are likely of Paleozoic age, and are considered not to be within a seismically active area. These faults are not considered to pose a significant hazard to the dam.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. **General.** A visual inspection of Potosi Lake Dam was made on 25 June 1980 without an owner's representative present. The dam is currently in generally poor condition.

b. **Dam.** The dam is constructed of a gravelly, dark red, plastic clay (CH) obtained from the reservoir area. The gravel is an angular chert ranging in size from coarse sand to cobbles.

The downstream slope of the dam has a dense growth of brush and trees (Photo 2). Trees growing on this slope have trunk diameters up to 18 in. On the upstream slope, wave erosion protection is provided by a 3- to 4-in. thick layer of medium-sized gravel. There are also scattered bushes growing above the water line. The potential for upstream slope erosion is low.

The vertical and horizontal alignment of the dam appear undisturbed. A paved, two-lane road crosses the dam crest. There was no evidence of sinkhole development, detrimental settlement, slides, depressions, cracking or animal burrows on the dam.

Clear seepage was noted along about a 100-ft length of the dam toe in the area of the maximum section. The rate of seepage was estimated to be 30 to 50 gal/min. Seepage was not concentrated at any single point, but rather in a band at the toe of the dam (see Fig A1; Appendix A).

At the outlet of the siphon, a hole about 3-ft deep and 15-ft in diameter has been scoured at the toe.

c. **Appurtenant structures.**

1. Main spillway. The main spillway is a 3-ft dia corrugated metal pipe with a concrete headwall. It does not have a bituminous coating nor a paved invert. At the time of inspection, there was significant corrosion of the invert. About 5-ft upstream from the entrance, a wire mesh fence has been erected to prevent clogging of the culvert by floating debris.

2. Auxiliary spillway. The auxiliary spillway is a 2-ft dia corrugated metal pipe with a projecting entrance. It does not have a bituminous coating nor a paved invert. At the time of inspection, it was half-filled with sediment and the entrance was partially blocked by debris.

3. Siphon. The siphon consists of a 12-in. dia steel pipe with an air vent at the throat (Photo 1; Appendix A). The throat crest is above the dam crest elevation. Therefore, the siphon must be started manually as it will not flow until the lake elevation reaches a level above the vent. The outlet is at the dam toe. The lower leg passes under the road and rests on the downstream slope of the dam. Details of the inlet are not available. The exposed portions of the siphon appeared to be in good condition.

d. **Reservoir area.** The reservoir is used for recreational purposes. Many vacation houses have been constructed on the slopes surrounding the lake and on the lake shore. Slopes are generally flatter than 4(H) to 1(V) but are steeper locally. No signs of instability were observed. Sediment transport into the lake appears to be insignificant.

e. **Downstream channel.** The downstream channel is cut into earth and unlined for most of its length. It is roughly trapezoidal in shape and filled with brush. The soil appears to be moderately erodible.

3.2 Evaluation

Our visual inspection did not reveal any signs of instability but the dense plant growth on the downstream slope limited observation. This dense plant growth is considered to be a potential hazard to the safety of the dam. However, removal of

large trees should be done under the guidance of an engineer experienced in the design and construction of earth dams. Indiscriminate clearing could jeopardize the safety of the dam.

The choice of CMP for the spillways is poor. It has relatively short life and is easily blocked. The CMP spillways should be periodically cleaned and checked for deterioration.

The clear seepage exiting the toe of the dam does not appear to pose a hazard to the dam at this time. There is no evidence of piping as there are no suspended solids in the seepage. This seepage, however, could become a problem if it becomes turbid (indicating piping is occurring) or if the volume of seepage increases. A monitoring program should be implemented to detect changes in the seepage flow or turbidity.

The scouring by the water discharging from the siphon does not appear to pose a safety hazard to the dam at this time. Continued scouring at the toe of the dam should be avoided as it may eventually endanger the stability of the dam.

The downstream channel is sufficiently far away from the dam that its erosion will not endanger the dam.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

So far as could be determined there are no operational procedures for this dam. The water level is controlled by the inlet elevation of the main spillway.

4.2 Maintenance of the Dam

No records of maintenance on this facility were available.

4.3 Maintenance of Operating Facilities

There are no operating facilities at this dam.

4.4 Descriptions of Any Warning System in Effect

A warning system was not identified in the inspection.

4.5 Evaluation

There are apparently no maintenance or operational procedures in effect for this dam. The lack of regular maintenance and periodic inspection is considered a deficiency.

The feasibility of a practical warning system should be evaluated to alert the downsteam residents should potentially hazardous conditions develop during periods of heavy precipitation.

SECTION 5
HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. **Design data.** No hydrologic or hydraulic information was available for evaluation of the dam. Pertinent dimensions of the dam and reservoir were surveyed on 25 June 1980, measured during the field inspection or estimated from topographic mapping. The map used in the analysis was the USGS Mineral Point 7.5-minute quadrangle map.

b. **Experience data.** No recorded history of rainfall, runoff, discharge or pool stage data were available for this reservoir or watershed. Mr John Head who has resided along the lake for 25 years, stated that the dam was severely overtopped about 10 to 15 years ago. It occurred during a heavy rainstorm when the 3-ft dia culvert was blocked by a log. Prior to installation of the 2-ft dia culvert, overtopping had occurred several times according to Mr Head. This was reported as only "trickling" over the dam crest.

c. **Visual observation.** Blockage of culverts due to debris could lead to a reduced spillway capacity during a flood occurrence. Other observations regarding the reservoir, spillway and downstream channel are given in Section 3.

d. **Overtopping potential.** The hydrologic/hydraulic analyses indicate that the dam will be overtopped for the 10 percent probability-of-occurrence event.

These analyses also indicate that the dam will be overtopped for a hydrologic event which produces greater than eight percent of the Probable Maximum Flood (PMF). The PMF is defined as the flood event that may be expected to occur from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The following table presents the expected severity of overtopping for various percentages of the PMF:

Percent PMF	Maximum Reservoir W.S. Elev. ft, MSL	Maximum Depth over Dam, ft	Maximum Outflow, ft^3/sec	Duration of Overtopping, hrs
8	875.3	0	55	0
50	877.3	1.8	1850	12.0
100	878.1	2.6	3730	15.7

The embankment material is considered to be moderately erodible and some protection is provided on the downstream slope by the dense plant growth. The duration and depth of the flood flow over the dam at 50 and 100 percent of the PMF could cause significant erosion and possibly a breach of the dam. The point of overtopping is at the maximum dam section, the least desirable location for erosion to take place. It is recommended that the spillway design storm for this dam be the PMF. This is based on the likelihood of further housing development in the downstream hazard zone, the depth and duration of overtopping and the anticipated consequent erosion of the downstream face of the dam. Further detailed hydrologic studies as well as inundation studies which are beyond the scope of this report, may show that designing and constructing the spillway to accommodate a spillway design flood of less than the PMF would reduce the depth and duration of overtopping by the PMF to acceptable amounts.

SECTION 6
STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. **Visual inspection.** The visual inspection of the Potosi Lake Dam revealed no evidence of horizontal or vertical displacement of the dam crest alignment. Cracking, detrimental settlement, slides, depressions or other signs of instability were not observed. It should be noted, however, that the trees growing on the downstream slope may have obscurred signs of instability.

Seepage was observed at the toe of the dam but did not appear to constitute an immediate danger to the stability of the dam. Section 3.1b and 3.2 further address this condition.

b. **Design and construction data.** No design or construction data were available for this dam. Seepage and stability analyses comparable to the requirements of the guidelines were not available. This is a deficiency.

c. **Operating records.** No operating records or water level records are maintained for this facility.

d. **Post construction changes.** The changes to the dam since its construction are outlined in Sectin 1.2g of this report. There have been no structural changes to the dam that seem to have affected its stability. There were no construction reports located for this dam.

e. **Seismic stability.** The dam is Seismic Zone 2, to which the guidelines assign a moderate damage potential. In view of the gravelly clay used in the construction of the dam, liquefaction is unlikely during a seismic event. However, since a static stability analysis is not available for review, the seismic stability cannot be evaluated.

SECTION 7
ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

a. **Safety.** Based on the visual inspection, the Potosi Lake Dam is judged to be in generally poor condition. The small spillway capacity, the high potential for spillway blockage, dense plant growth on the downstream slope, lack of maintenance and periodic inspections are the primary reasons for this judgment. Seepage and stability analyses comparable to the requirements of the guidelines were not available, which is a deficiency.

b. **Adequacy of information.** The visual inspection provided a reasonable base of information for the conclusions and recommendations presented for this Phase I report. The lack of design documents such as static and seismic stability analyses and a seepage analysis for the dam as recommended in the guidelines precludes an evaluation of the static and seismic stability of the dam. This is a deficiency.

c. **Urgency.** The deficiencies described in this report could affect the safety of the dam. Corrective actions that should be initiated immediately are addressed in Section 7.2b.

d. **Necessity for Phase II.** In accordance with the Recommended Guidelines for Safety Inspections of Dams, the subject investigation is a minimum study. This study revealed that additional in-depth investigations are needed to complete the assessment of the safety of the dam. Those investigations which should be performed immediately are described in Section 7.2b. It is our understanding from discussions with the St Louis District that any additional investigations are the responsibility of the owner.

7.2 Remedial Measures

a. **Alternatives.** There are several general options which may be considered to reduce the possibility of dam failure or to diminish the harmful consequences of such a failure. Some of these options are:

1. Remove the dam, or breach it to prevent storage of water.

2. Increase the height of dam and/or spillway size to pass the probable maximum flood without overtopping the dam.

3. Purchase downstream land that would be adversely impacted by dam failure and restrict human occupancy.

4. Enhance the stability of the dam to permit overtopping by the probable maximum flood without failure.

5. Provide a highly reliable flood warning system (generally does not prevent damage but diminishes the likelihood of loss of life).

b. **Recommendations.** Based on our inspection of Potosi Lake Dam it is recommended that further study be conducted to evaluate, as a minimum, the following:

1. Design and construction of a spillway and/or increasing the dam crest elevation to provide adequate discharge and/or storage capacity to be able to pass the PMF with low danger to the downstream residents and property. Further detailed hydrologic studies, as well as inundation studies which are beyond the scope of this report, may show that designing and constructing the spillway to accommodate a spillway design flood of less than 100 percent the PMF would reduce the depth and duration of overtopping by the PMF to acceptable amounts.

2. A program to remove the dense plant growth from the dam downstream slope.

3. Seepage and stability analyses in accordance with the requirements of the guidelines.

All remedial measures including removal of trees should be performed under the guidance of an engineer experienced in the design and construction of earth dams. It should be noted that indiscriminate removal of trees could

jeopardize the safety of the dam. Measures concerning the design of the dam spillway and crest should be performed immediately. All other measures should be done without undue delay.

c. **O & M procedures.** To provide for adequate maintenance of this facility it is recommended that a program of periodic inspections be implemented. The purpose of this program is to identify maintenance requirements. The inspection and maintenance should be performed under the guidance of an engineer experienced in the design and construction of earth dams. Records of the inspection and maintenance performed should be kept.

Particular attention during the inspections should be given to the seepage at the toe of the dam. Should the seepage become turbid or increase in volume, it may be an indication of a serious problem. Attention should also be given to the deterioration of the siphon and the plunge pool at the discharge point. Leakage from the siphon could create piping and endanger the dam, as could enlargement of the plunge pool at the toe of the dam.

REFERENCES

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Hydrologic Engineering Center, US Army Corps of Engineers, 1978, "Flood Hydrograph Package (HEC-1) Users Manual for Dam Safety Investigations".

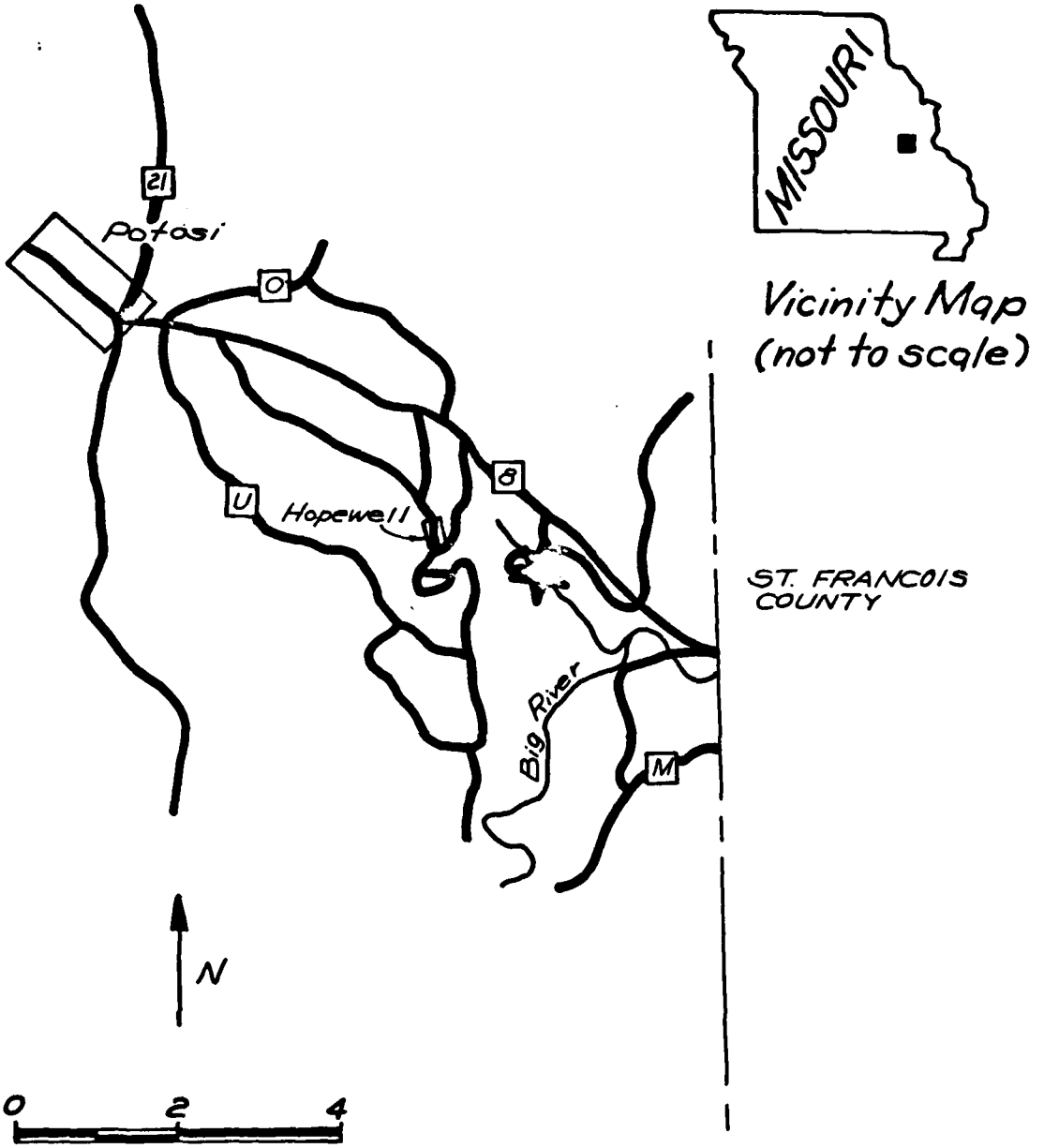
McCracken, Mary H., 1971, Structural Features Map of Missouri: Missouri Geological Survey, Scale 1:500,000.

Missouri Geological Survey, 1979, Geologic Map of Missouri: Missouri Geological Survey, Scale 1:500,000.

St Louis District, US Army Corps of Engineers, 1979, "Hydrologic/Hydraulic Standards, Phase I Safety Inspection of Non-Federal Dams".

US Department of Commerce, US Weather Bureau, 1956, "Seasonal Variation of the Probable Maximum Precipitation East of the 105th Meridian for Areas from 10 to 1,000 Square Miles and Durations of 6, 12, 24 and 48 Hours," Hydrometeorological Report No. 33.

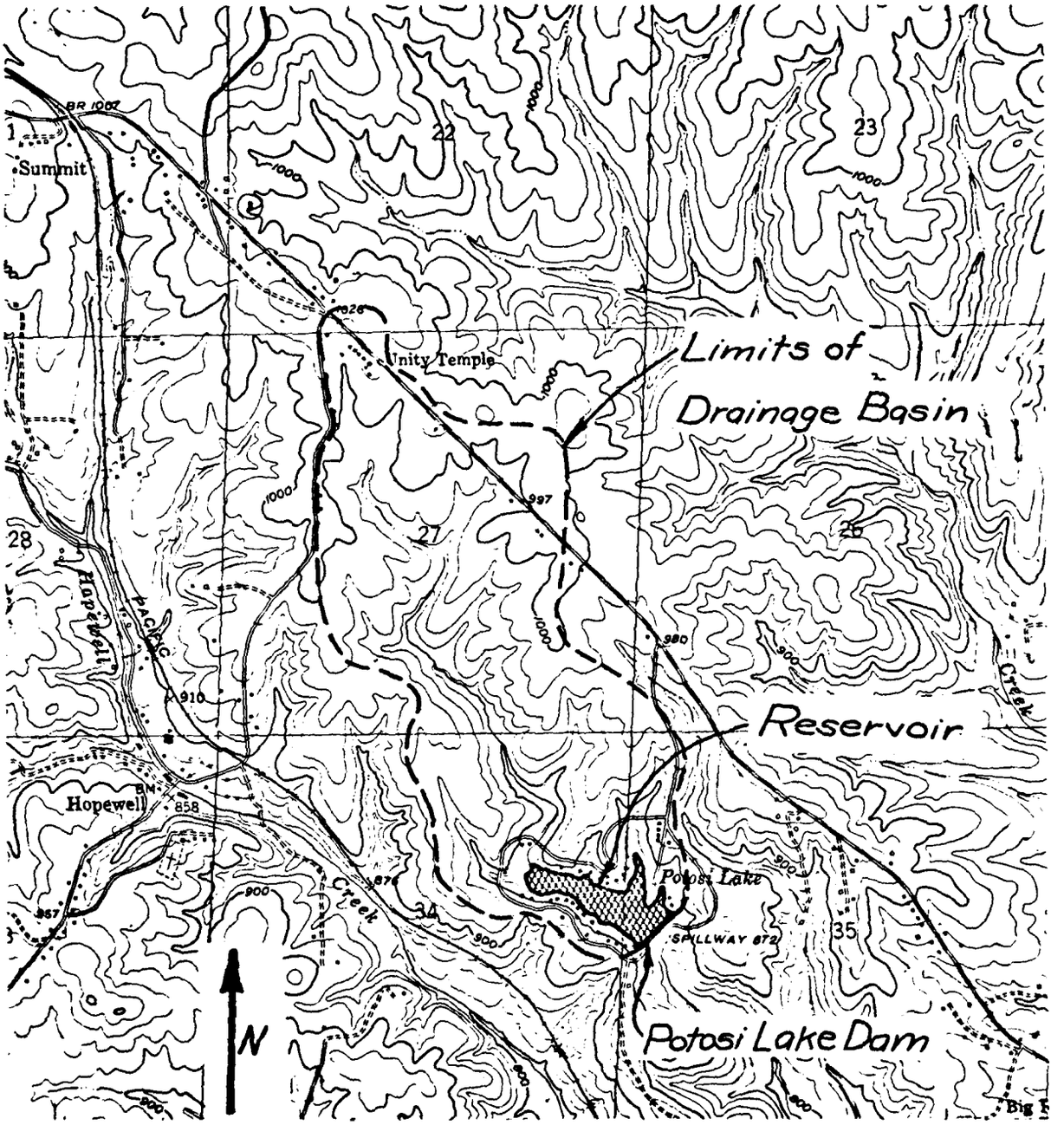
US Soil Conservation Service, 1971, "National Engineering Handbook," Section 4, Hydrology, 1971.



Legend

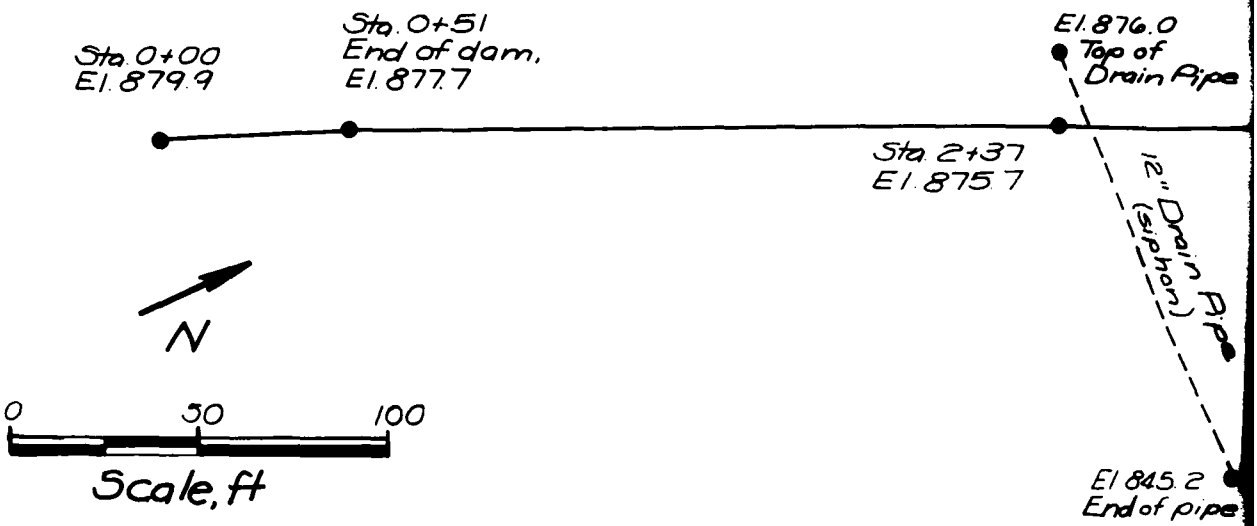
- County Line
- State highway and Route No.
- River or Creek
- City or Town
- Project location

SITE LOCATION MAP	
POTOSI LAKE DAM	
MO 30477	Fig. 1

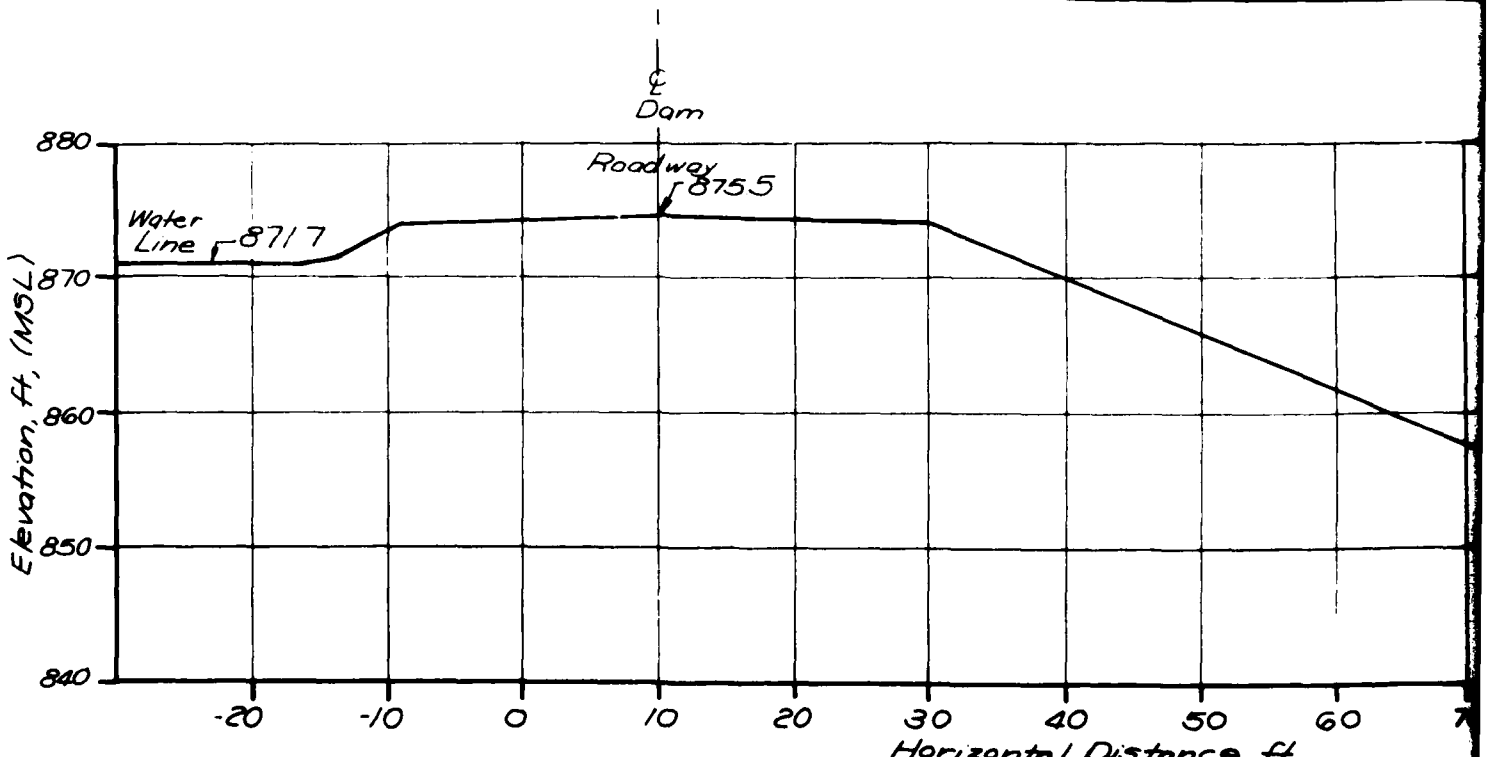


1. Topography from U.S.G.S. Mineral Point 7½ minute quadrangle map.

DRAINAGE BASIN AND SITE TOPOGRAPHY	
POTOSI LAKE DAM	
MO 30477	Fig. 2

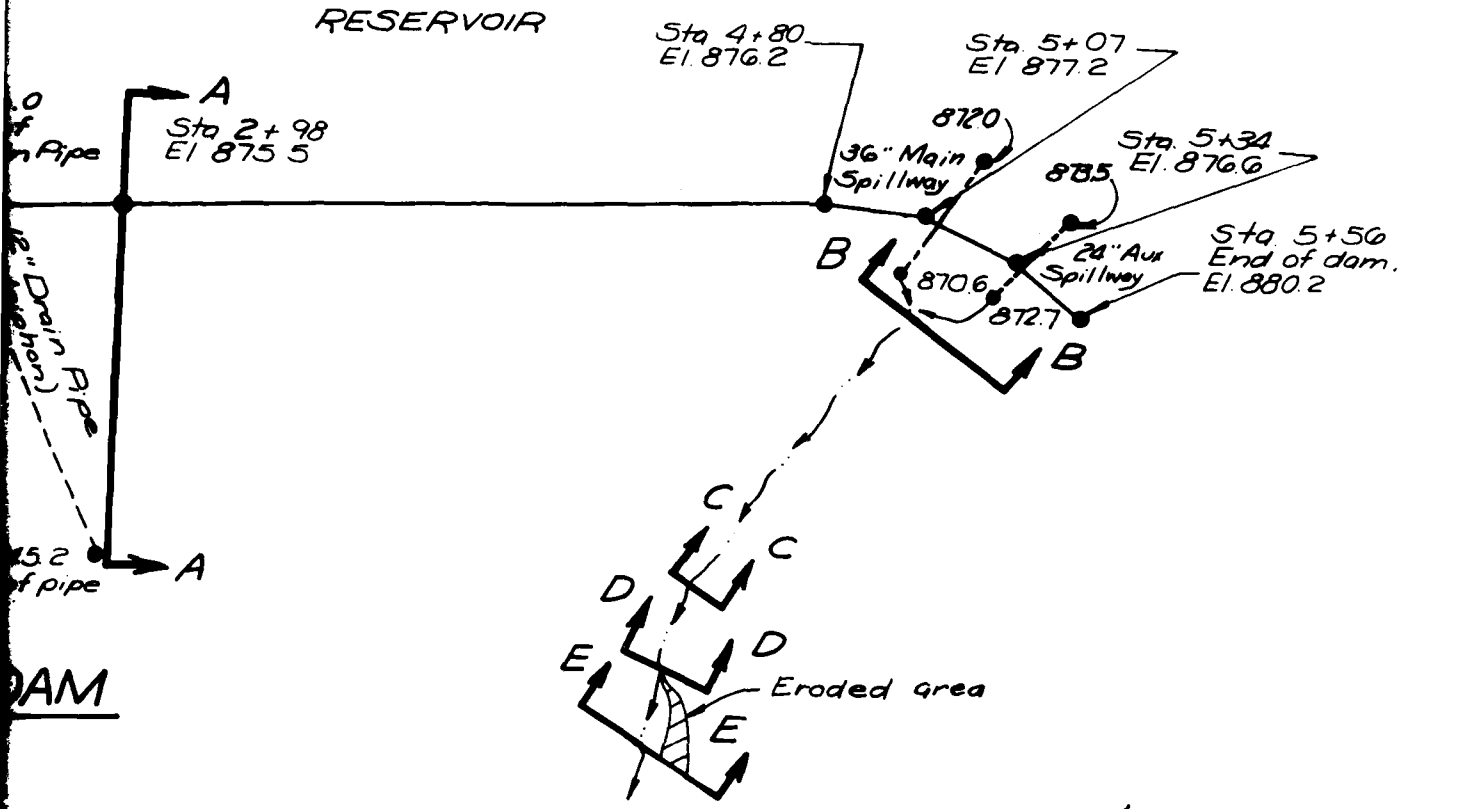


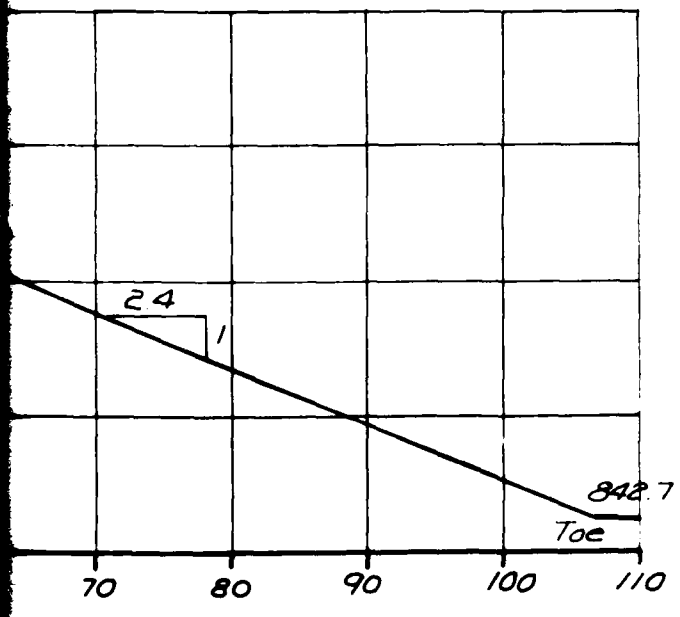
PLAN OF DAM



SECTION A-A

Maximum Section

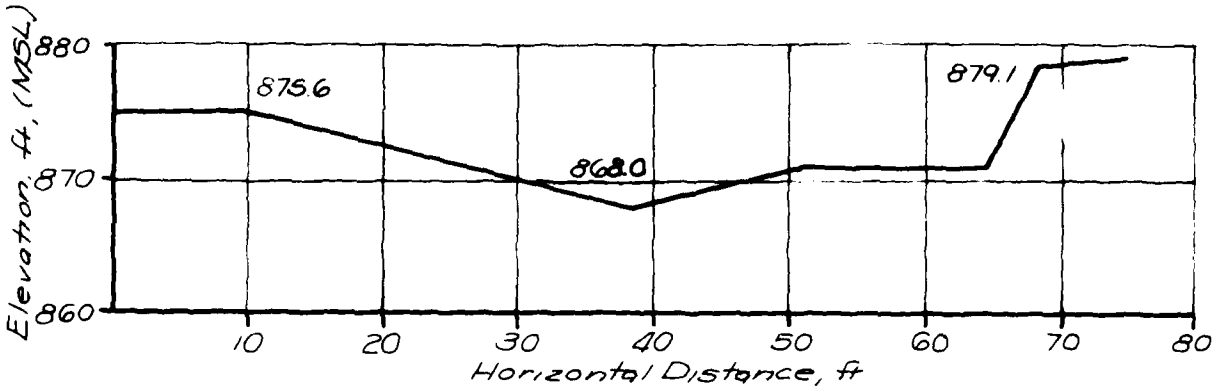




Legend

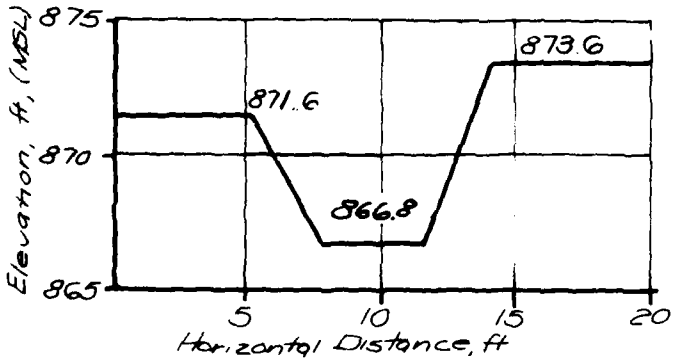
Discharge channel

PLAN OF DAM AND MAXIMUM SECTION	
POTOSI LAKE DAM	
MO 30477	Fig. 3A



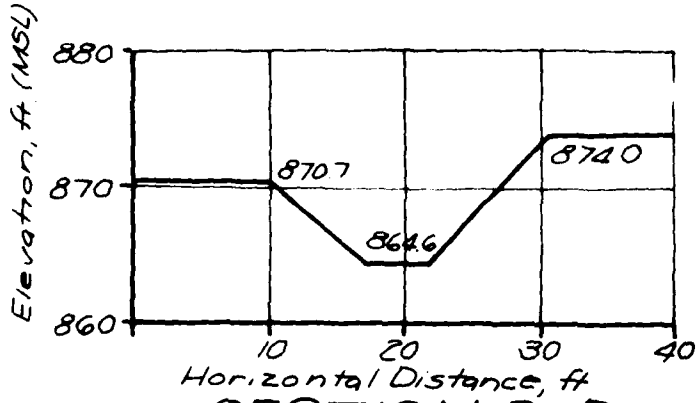
SECTION B-B

Clay Bottomed Discharge Channel



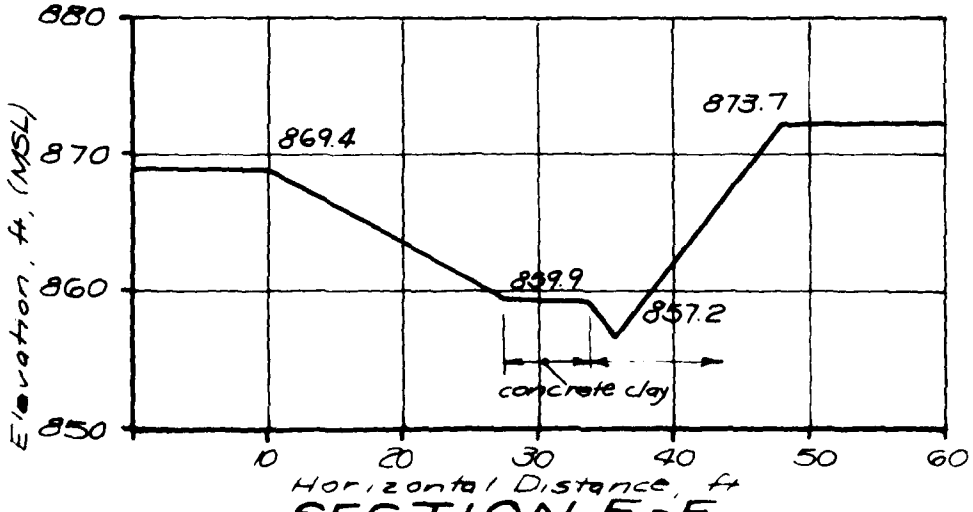
SECTION C-C

Concrete Floored Discharge Channel



SECTION D-D

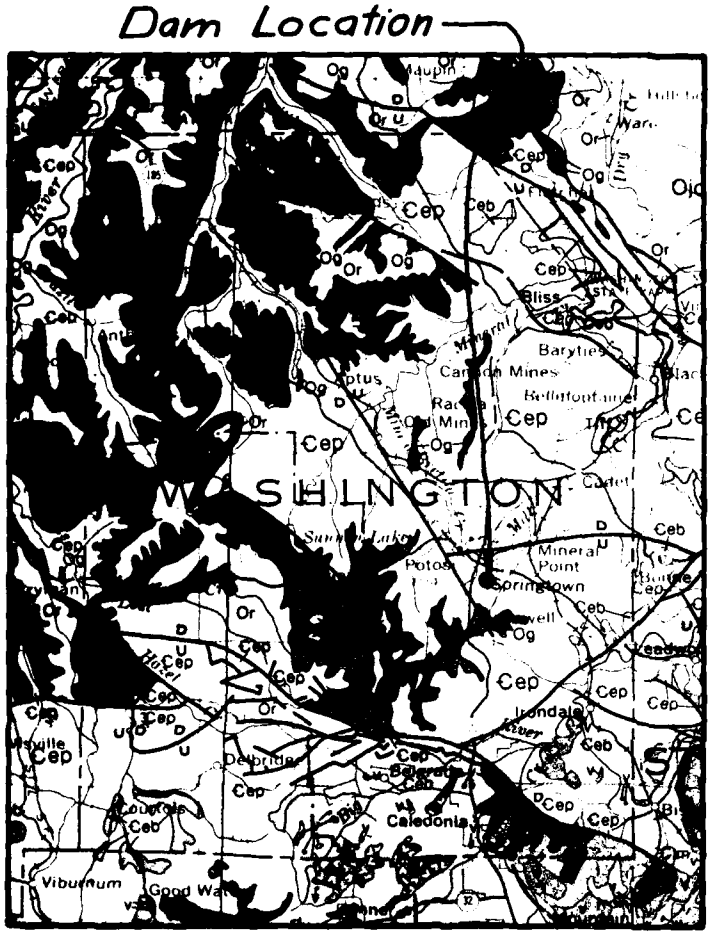
Concrete Floored Discharge Channel



SECTION E-E

Concrete Floored Discharge Channel

SECTIONS OF DISCHARGE CHANNEL	
POTOSI LAKE DAM	
MO 30477	Fig. 3B



N

0 10 20

Scale, mile

Legend

- Or — Roubidoux Formation
- Gasconade Dolomite
  - Gunter Sandstone Member
- Cep — Eminence Dolomite
- Potosi Dolomite
- Derby-Doerun Dolomite
- Ceb — Davis Formation
- Bonneterre Formation
  - Whetstone Creek Member
  - Sullivan Siltstone Member
- Reagan Sandstone (subsurface, western Missouri)
- Lamotte Sandstone
- Diabase (dikes and sills)
- St. Francois Mountains Intrusive Suite
- St. Francois Mountains Volcanic Supergroup

REGIONAL GEOLOGIC MAP

POTOSI LAKE DAM

MO 30477 | **Fig. 4**

APPENDIX A

Photographs

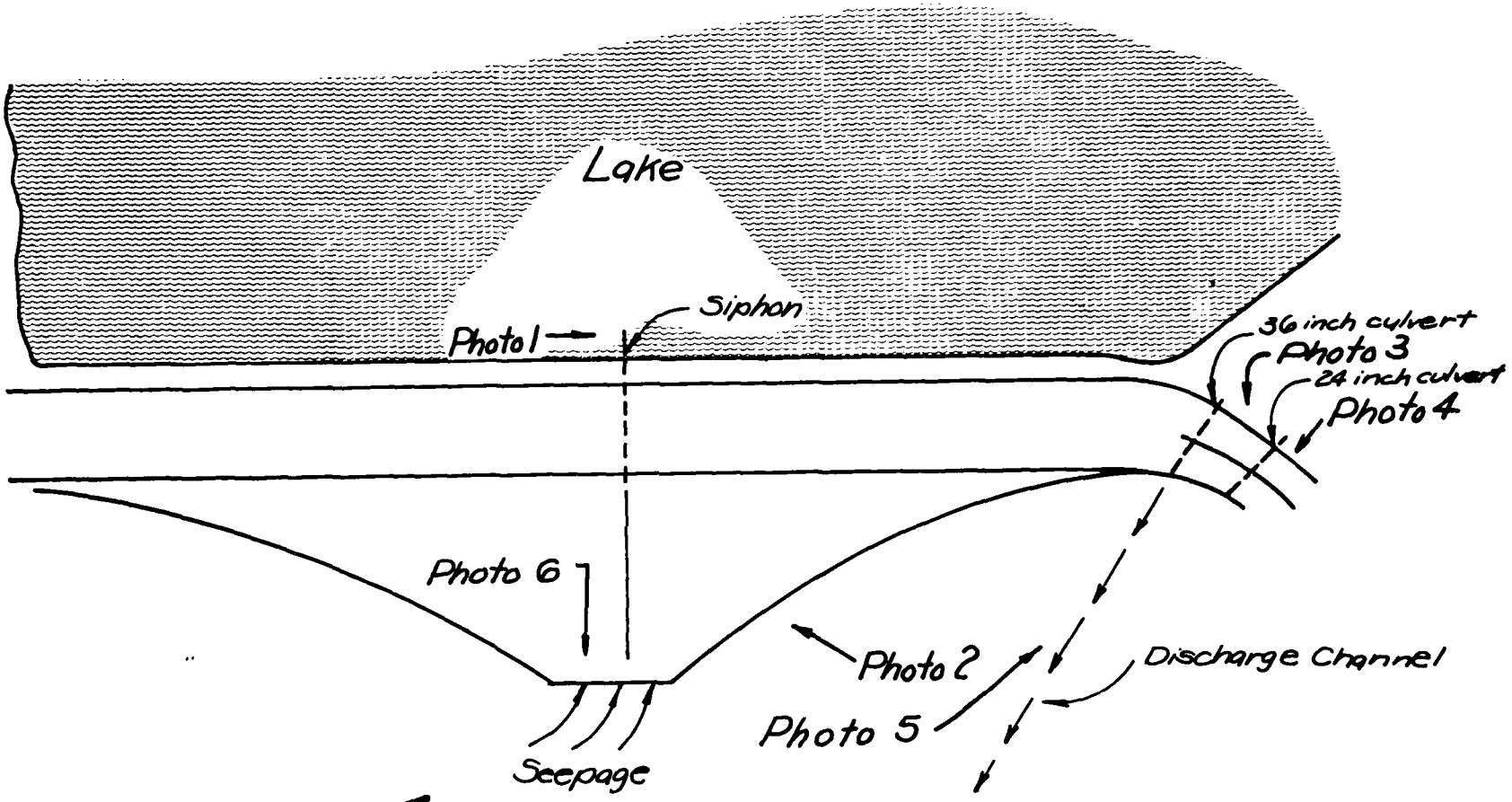


PHOTO LOCATION SKETCH	
POTOSI LAKE DAM	
MO 30477	Fig. A-1

1. Upstream dam slope showing siphon inlet and gravel wave protection.

2. Heavy growth on downstream slope.

3. Entrance of 3-ft diameter culvert which is main spillway.

4. Entrance of 2-ft diameter culvert which is auxiliary spillway.

5. Discharge channel about 200 ft from spillway. Looking upstream.

6. Downstream channel from toe of dam. Water is from seepage from toe.

APPENDIX B

Hydraulic/Hydrologic Data and Summary

APPENDIX B
Hydraulic/Hydrologic Data and Analyses

B.1 Procedures

a. General. The hydraulic/hydrologic analyses were performed using the "HEC-1, Dam Safety Version (1 Apr 80)" computer program. The inflow hydrographs were developed for various precipitation events by applying them to a synthetic unit hydrograph. The inflow hydrographs were subsequently routed through the reservoir and appurtenant structures by the modified Puls reservoir routing option.

b. Precipitation events. The Probable Maximum Precipitation (PMP) and the 1 and 10 percent probability-of-occurrence events were used in the analyses. The total rainfall and corresponding distributions for the 1 and 10 percent probability events were provided by the St. Louis District, Corps of Engineers. The Probable Maximum Precipitation was determined from regional curves prepared by the US Weather Bureau (Hydrometeorological Report Number 33, 1956).

c. Unit hydrograph. The Soil Conservation Services (SCS) Dimensionless Unit Hydrograph method (National Engineering Handbook, Section 4, Hydrology, 1971) was used in the analysis. This method was selected because of its simplicity, applicability to drainage areas less than 10 mi^2, and its easy availability within the HEC-1 computer program.

The watershed lag time was computed using the SCS "curve number method" by an empirical relationship as follows:

$$L = \frac{\ell^{0.8}\,(s+1)^{0.7}}{1900\,Y^{0.5}} \qquad \text{(Equation 15-4)}$$

where: L = lag in hours
ℓ = hydraulic length of the watershed in feet
$s = \frac{1000}{CN} - 10$ where CN = hydrologic soil curve number
Y = average watershed land slope in percent

This empirical relationship accounts for the soil cover, average watershed slope and hydraulic length.

With the lag time thus computed, another empirical relationship is used to compute the time of concentration as follows:

$$T_c = \frac{L}{0.6} \qquad \text{(Equation 15-3)}$$

where: T_c = time of concentration in hours

L = lag in hours.

Subsequent to the computation of the time of concentration, the unit hydrograph duration was estimated utilizing the following relationship:

$$\Delta D = 0.133 T_c \qquad \text{(Equation 16-12)}$$

where: ΔD = duration of unit excess rainfall
T_c = time of concentration in hours.

The final interval was selected to provide at least three discharge ordinates prior to the peak discharge ordinate of the unit hydrograph. For this dam, a time interval of 10 minutes was used.

d. Infiltration losses. The infiltration losses were computed by the HEC-1 computer program internally using the SCS curve number method. The curve numbers were established taking into consideration the variables of: (a) antecedent moisture condition, (b) hydrologic soil group classification, (c) degree of development, (d) vegetative cover and (e) present land usage in the watershed.

Antecedent moisture condition III (AMC III) was used for the PMF events and AMC II was used for the 1 and 10 percent probability events, in accordance with the guidelines. The remaining variables are defined in the SCS procedure and judgements in their selection were made on the basis of visual field inspection.

e. Starting elevations. Reservoir starting water surface elevations for this dam were set as follows:

(1) 1 and 10 percent probability events - spillway crest elevation which is the high water mark

(2) Probable Maximum Storm - spillway crest elevation

Because the 12-in diameter steel siphon pipe requires manual starting, it was assumed that it did not pass significant flows and was therefore essentially blocked or inoperable.

f. Spillway Rating Curve. The outflow rating curve for the 24-in. and 36-in. diameter spillway culverts was estimated using the Corps of Engineers generalized computer program HEC-2 "Water Surface Profile, Bridge Routine". Various flows were specified and the corresponding water surface elevations were estimated by the program. These data were then input on the Y-4 and Y-5 cards for the overtopping analysis. The technique is described in Training Document #6, "Applications of the HEC-2 Bridge Routines", June 1974.

B.2 Pertinent Data

a. Drainage area. 0.86 mi^2

b. Storm duration. A unit hydrograph was developed by the SCS method option of HEC-1 program. The design storm of 48 hours duration was divided into 10 minute intervals in order to develop the inflow hydrograph.

c. Lag time. 1.4 hrs

d. Hydrologic soil group. D

e. SCS curve numbers.

1. For PMF- AMC III - Curve Number 89
2. For 1 and 10 percent probability-of-occurrence events AMC II - Curve Number 77

f. Storage. Elevation-area data were developed by planimetering areas at various elevation contours on the USGS Mineral Point 7.5-minute quadrangle map. The data were entered on the $A and $E cards so that the HEC-1 program could compute storage volumes.

g. Outflow over dam crest. As the profile of the dam crest is irregular, flow over the crest was computed according to the "Flow Over Non-Level Dam Crest" supplement to the HEC-1 User's Manual. The crest length-elevation data and hydraulic constants were entered on the $D, $L, and $V cards.

h. Outflow capacity. The spillway rating curve was developed using the HEC-2 technique identified in paragraph B.1.f in this Appendix. The results of the above were entered on the Y-4 and Y-5 cards of the HEC-1 program.

i. Reservoir elevations. For the 50 and 100 percent of the PMF events, the starting reservoir elevation was 872.0 ft, the spillway crest elevation. For the 1 and 10 percent probability-of-occurrence events, the starting reservoir elevation was 872.0 ft, the elevation of the high water line in the reservoir area which is also the spillway crest elevation.

B.3 Results

The results of the analyses as well as the input values to the HEC-1 program follow in this Appendix. Only the results summaries are included, not the intermediate output. Complete copies of the HEC-1 output are available in the project files.

```
**********************************
*FLOOD HYDROGRAPH PACKAGE (HEC-1)
*DAM SAFETY VERSION      JULY 1978
* LAST MODIFICATION   01 APR 80
**********************************
     1          A1     DAM NO. 30477 - POTOSI LAKE, WASHINGTON COUNTY, MISSOURI.
     2          A2     WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 79CH009.
     3          A3     PROBABLE MAXIMUM FLOOD RATIO FLOODS.
     4          B    288       0      10      -0      -0      -0      -0      -0      -0      -0
     5          B1     5
     6          J      1       2       1
     7          J1   .50     1.0
     8          K      0    0-IN                                                    1
     9          K1   POTOSI LAKE PMF RATIO INFLOW HYDROGRAPHS.
    10          M      1       2   0.857                           1                       1
    11          P      0      26.     102.    120.    130.    140.
    12          T                                                          -1     -89                .06
    13          W2             1.4
    14          X     -2    -.05       5
    15          K      1     DAM                                                     1
    16          K1   POTOSI LAKE PMF ROUTING AND OVERTOPPING ANALYSIS.
    17          Y                                      1       1
    18          Y1     1                                                  -872.0     -1
    19          Y4 872.0   873.4   874.5   875.2   875.9   877.2   879.8
    20          Y5    0.    10.0    30.0    50.0    70.0   100.0   150.0
    21          SA    0.    10.5    16.2    26.0    38.5    54.0    70.9
    22          SE 838.8   850.0   860.0   870.0   880.0   890.0   900.0
    23          SS872.0
    24          SD 875.5     2.6     1.5
    25          SL    0.   220.0   385.0   470.0   510.0   560.0
    26          SV 875.5   876.0   877.0   878.0   879.0   880.0
    27          K     99
```

Input Data
Various PMF Events
Potosi Lake Dam
MO. ID. No. 30477
B4

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION  JULY 1978
LAST MODIFICATION  01 APR 80
**********

RUN DATE: 29 SEP 80
TIME: 19.57.46
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DAM NO. 30477 - POTOSI LAKE, WASHINGTON COUNTY, MISSOURI.
WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 79CH009.
PROBABLE MAXIMUM FLOOD RATIO FLOODS.

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	-0	-0	-0	-0	-0	-0	-0

JOPER	NWT	LROPT	TRACE
5	-0	-0	-0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1
RTIOS= .50 1.00

****

SUB-AREA RUNOFF COMPUTATION

POTOSI LAKE PMF RATIO INFLOW HYDROGRAPHS.

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
0-IN	0	-0	-0	-0	-0	1	-0	-0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	.86	-0.	.86	1.00	-0.	-0	1	-0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.	26.00	102.00	120.00	130.00	140.00	-0.	-0.

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
-0	-0.	-0.	1.00	-0.	-0.	1.00	-1.00	-89.00	-0.	.06

CURVE NO = -89.00 WETNESS = -1.00 EFFECT CN = 89.00

UNIT HYDROGRAPH DATA
TC= -0. LAG= 1.40

RECESSION DATA
STRTQ= -2.00 QRCSN= -.05 RTIOR= 5.00

RECESSION DATA

STRTQ= -2.00 QRCSN= -.05 RTIOR= 5.00

UNIT HYDROGRAPH 44 END OF PERIOD ORDINATES. TC= -0. HOURS. LAG= 1.40 VOL= 1.00

11.	34.	65.	109.	164.	217.	255.	276.	279.	272.	
252.	229.	201.	165.	132.	109.	91.	76.	64.	54.	
44.	37.	31.	26.	21.	18.	15.	12.	10.	9.	
7.	6.	5.	4.	3.	3.	3.	2.	2.	1.	
1.	1.	0.	0.							

Q

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.10	1	.00	.00	.00	1.	1.02	.10	145	.03	.03	.00	10.
1.01	.20	2	.00	.00	.00	1.	1.02	.20	146	.03	.03	.00	11.
1.01	.30	3	.00	.00	.00	1.	1.02	.30	147	.03	.03	.00	12.
1.01	.40	4	.00	.00	.00	1.	1.02	.40	148	.03	.03	.00	13.
1.01	.50	5	.00	.00	.00	1.	1.02	.50	149	.03	.03	.00	14.
1.01	1.00	6	.00	.00	.00	1.	1.02	1.00	150	.03	.03	.00	24.
1.01	1.10	7	.00	.00	.00	1.	1.02	1.10	151	.03	.03	.00	29.
1.01	1.20	8	.00	.00	.00	1.	1.02	1.20	152	.03	.03	.00	36.
1.01	1.30	9	.00	.00	.00	1.	1.02	1.30	153	.03	.03	.00	42.
1.01	1.40	10	.00	.00	.00	1.	1.02	1.40	154	.03	.03	.00	48.
1.01	1.50	11	.00	.00	.00	1.	1.02	1.50	155	.03	.03	.00	54.
1.01	2.00	12	.00	.00	.00	1.	1.02	2.00	156	.03	.03	.00	59.
1.01	2.10	13	.00	.00	.00	1.	1.02	2.10	157	.03	.03	.00	64.
1.01	2.20	14	.00	.00	.00	1.	1.02	2.20	158	.03	.03	.00	68.
1.01	2.30	15	.00	.00	.00	1.	1.02	2.30	159	.03	.03	.00	71.
1.01	2.40	16	.00	.00	.00	0.	1.02	2.40	160	.03	.03	.00	74.
1.01	2.50	17	.00	.00	.00	0.	1.02	2.50	161	.03	.03	.00	76.
1.01	3.00	18	.00	.00	.00	0.	1.02	3.00	162	.03	.03	.00	78.
1.01	3.10	19	.00	.00	.00	0.	1.02	3.10	163	.03	.03	.00	79.
1.01	3.20	20	.00	.00	.00	0.	1.02	3.20	164	.03	.03	.00	81.
1.01	3.30	21	.00	.00	.00	0.	1.02	3.30	165	.03	.03	.00	82.
1.01	3.40	22	.00	.00	.00	0.	1.02	3.40	166	.03	.03	.00	83.
1.01	3.50	23	.00	.00	.00	0.	1.02	3.50	167	.03	.03	.00	84.
1.01	4.00	24	.00	.00	.00	0.	1.02	4.00	168	.03	.03	.00	84.
1.01	4.10	25	.00	.00	.00	0.	1.02	4.10	169	.03	.03	.00	85.
1.01	4.20	26	.00	.00	.00	0.	1.02	4.20	170	.03	.03	.00	85.
1.01	4.30	27	.00	.00	.00	0.	1.02	4.30	171	.03	.03	.00	86.
1.01	4.40	28	.00	.00	.00	0.	1.02	4.40	172	.03	.03	.00	86.
1.01	4.50	29	.00	.00	.00	0.	1.02	4.50	173	.03	.03	.00	87.
1.01	5.00	30	.00	.00	.00	0.	1.02	5.00	174	.03	.03	.00	87.
1.01	5.10	31	.00	.00	.00	0.	1.02	5.10	175	.03	.03	.00	87.
1.01	5.20	32	.00	.00	.00	0.	1.02	5.20	176	.03	.03	.00	87.
1.01	5.30	33	.00	.00	.00	0.	1.02	5.30	177	.03	.03	.00	88.
1.01	5.40	34	.00	.00	.00	0.	1.02	5.40	178	.03	.03	.00	88.
1.01	5.50	35	.00	.00	.00	0.	1.02	5.50	179	.03	.03	.00	88.
1.01	6.00	36	.00	.00	.00	0.	1.02	6.00	180	.03	.03	.00	88.
1.01	6.10	37	.01	.00	.01	0.	1.02	6.10	181	.13	.12	.01	89.
1.01	6.20	38	.01	.00	.01	0.	1.02	6.20	182	.13	.12	.01	93.
1.01	6.30	39	.01	.00	.01	0.	1.02	6.30	183	.13	.12	.01	96.
1.01	6.40	40	.01	.00	.01	1.	1.02	6.40	184	.13	.12	.01	100.
1.01	6.50	41	.01	.00	.01	1.	1.02	6.50	185	.13	.12	.01	128.
1.01	7.00	42	.01	.00	.01	1.	1.02	7.00	186	.13	.12	.01	146.
1.01	7.10	43	.01	.00	.01	1.	1.02	7.10	187	.13	.12	.01	170.
1.01	7.20	44	.01	.00	.01	1.	1.02	7.20	188	.13	.12	.01	197.
1.01	7.30	45	.01	.00	.01	1.	1.02	7.30	189	.13	.12	.01	224.
1.01	7.40	46	.01	.00	.01	1.	1.02	7.40	190	.13	.12	.01	248.
1.01	7.50	47	.01	.00	.01	1.	1.02	7.50	191	.13	.12	.01	267.
[illegible]	[illegible]	48	.01	.00	.01	1.	1.02	8.00	192	.13	.13	.00	282.

Output Summary
Various PMF Events
Potosi Lake Dam
MO. ID. No. 30477
B6

Output Summary
Various PMF Events
Potosi Lake Dam
MO. ID. No. 30477
B7

1	16.20	98	.05	.04	.01	166.	1.02	16.20	242	.62	.62	.00	3664.
1.01	16.30	99	.05	.04	.01	188.	1.02	16.30	243	.62	.62	.00	3388.
1.01	16.40	100	.05	.04	.01	205.	1.02	16.40	244	.62	.62	.00	3820.
1.01	16.50	101	.05	.04	.01	216.	1.02	16.50	245	.62	.62	.00	3746.
1.01	17.00	102	.05	.04	.01	220.	1.02	17.00	246	.62	.62	.00	3768.
1.01	17.10	103	.04	.03	.01	220.	1.02	17.10	247	.49	.49	.00	3719.
1.01	17.20	104	.04	.03	.00	215.	1.02	17.20	248	.49	.49	.00	3559.
1.01	17.30	105	.04	.03	.00	207.	1.02	17.30	249	.49	.49	.00	3441.
1.01	17.40	106	.04	.03	.00	197.	1.02	17.40	250	.49	.49	.00	3244.
1.01	17.50	107	.04	.03	.00	185.	1.02	17.50	251	.49	.49	.00	3018.
1.01	18.00	108	.04	.03	.00	173.	1.02	18.00	252	.49	.49	.00	2799.
1.01	18.10	109	.00	.00	.00	163.	1.02	18.10	253	.04	.04	.00	2611.
1.01	18.20	110	.00	.00	.00	154.	1.02	18.20	254	.04	.04	.00	2444.
1.01	18.30	111	.00	.00	.00	145.	1.02	18.30	255	.04	.04	.00	2286.
1.01	18.40	112	.00	.00	.00	136.	1.02	18.40	256	.04	.04	.00	2129.
1.01	18.50	113	.00	.00	.00	125.	1.02	18.50	257	.04	.04	.00	1958.
1.01	19.00	114	.00	.00	.00	114.	1.02	19.00	258	.04	.04	.00	1775.
1.01	19.10	115	.00	.00	.00	103.	1.02	19.10	259	.04	.04	.00	1589.
1.01	19.20	116	.00	.00	.00	91.	1.02	19.20	260	.04	.04	.00	1407.
1.01	19.30	117	.00	.00	.00	80.	1.02	19.30	261	.04	.04	.00	1234.
1.01	19.40	118	.00	.00	.00	70.	1.02	19.40	262	.04	.04	.00	1072.
1.01	19.50	119	.00	.00	.00	60.	1.02	19.50	263	.04	.04	.00	926.
1.01	20.00	120	.00	.00	.00	52.	1.02	20.00	264	.04	.04	.00	798.
1.01	20.10	121	.00	.00	.00	45.	1.02	20.10	265	.04	.04	.00	684.
1.01	20.20	122	.00	.00	.00	39.	1.02	20.20	266	.04	.04	.00	591.
1.01	20.30	123	.00	.00	.00	34.	1.02	20.30	267	.04	.04	.00	516.
1.01	20.40	124	.00	.00	.00	30.	1.02	20.40	268	.04	.04	.00	454.
1.01	20.50	125	.00	.00	.00	27.	1.02	20.50	269	.04	.04	.00	402.
1.01	21.00	126	.00	.00	.00	24.	1.02	21.00	270	.04	.04	.00	359.
1.01	21.10	127	.00	.00	.00	21.	1.02	21.10	271	.04	.04	.00	322.
1.01	21.20	128	.00	.00	.00	19.	1.02	21.20	272	.04	.04	.00	292.
1.01	21.30	129	.00	.00	.00	18.	1.02	21.30	273	.04	.04	.00	267.
1.01	21.40	130	.00	.00	.00	16.	1.02	21.40	274	.04	.04	.00	247.
1.01	21.50	131	.00	.00	.00	15.	1.02	21.50	275	.04	.04	.00	229.
1.01	22.00	132	.00	.00	.00	14.	1.02	22.00	276	.04	.04	.00	214.
1.01	22.10	133	.00	.00	.00	14.	1.02	22.10	277	.04	.04	.00	202.
1.01	22.20	134	.00	.00	.00	13.	1.02	22.20	278	.04	.04	.00	191.
1.01	22.30	135	.00	.00	.00	12.	1.02	22.30	279	.04	.04	.00	182.
1.01	22.40	136	.00	.00	.00	12.	1.02	22.40	280	.04	.04	.00	174.
1.01	22.50	137	.00	.00	.00	11.	1.02	22.50	281	.04	.04	.00	167.
1.01	23.00	138	.00	.00	.00	11.	1.02	23.00	282	.04	.04	.00	162.
1.01	23.10	139	.00	.00	.00	11.	1.02	23.10	283	.04	.04	.00	159.
1.01	23.20	140	.00	.00	.00	11.	1.02	23.20	284	.04	.04	.00	156.
1.01	23.30	141	.00	.00	.00	10.	1.02	23.30	285	.04	.04	.00	153.
1.01	23.40	142	.00	.00	.00	10.	1.02	23.40	286	.04	.04	.00	151.
1.01	23.50	143	.00	.00	.00	10.	1.02	23.50	287	.04	.04	.00	150.
1.02	0.	144	.00	.00	.00	10.	1.03	0.	288	.04	.04	.00	148.
									SUM	36.40	35.04	1.36	114767.
										925.11	890.11	34.91	3248.149

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	3769.	2252.	760.	398.	114645.
CMS	107.	64.	22.	11.	3246.
INCHES		24.44	32.99	34.57	34.57
MM		620.84	837.98	878.01	878.01
AC-FT		1117.	1507.	1579.	1579.
THOUS CU M		1377.	1859.	1948.	1948.

HYDROGRAPH AT STA Q-IN FOR PLAN 1. RTIO 1

Output Summary
Various PMF Events
Potosi Lake Dam
MO. ID. No. 30477
B8

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2
				.50	1.00
HYDROGRAPH AT	O-IN	.86	1	1884.	3768.
		(2.22)		(53.35)(	106.70)(
ROUTED TO	DAM	.86	1	1849.	3732.
		(2.22)		(52.37)(	105.68)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1		INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	ELEVATION	872.00	872.00	875.50
	STORAGE	438.	438.	544.
	OUTFLOW	0.	0.	59.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.50	877.33	1.83	606.	1849.	12.00	41.17	0.
1.00	878.10	2.60	633.	3732.	15.67	41.17	0.

Output Summary
Various PMF Events
Potosi Lake Dam
MO. ID. No. 30477
B9

EQUIVALENT PMF

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**********************************
*FLOOD HYDROGRAPH PACKAGE (HEC-1)
*DAM SAFETY VERSION      JULY 1978
* LAST MODIFICATION  01 APR 80
**********************************

RUN  DATE: 29 SEP 80
     TIME: 15.51.00
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DAM NO. 30477 - POTOSI LAKE, WASHINGTON COUNTY, MISSOURI.
WOODWARD-CLYDE CONSULTANTS, HOUSTON JOB 79CH009.
PROBABLE MAXIMUM FLOOD RATIO FLOODS.

JOB SPECIFICATION

NQ	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
288	0	10	-0	-0	-0	-0	-0	5	-0
			JOPER	NWT	LROPT	TRACE			
			5	-0	-0	-0			

SURFACE AREA=	0.	11.	16.	26.	39.	54.	71.
CAPACITY=	0.	42.	174.	384.	704.	1164.	1787.
ELEVATION=	838.	850.	860.	870.	880.	890.	900.

CREL	SPWID	COQW	EXPW	ELEVL	COOL	CAREA	EXPL
872.0	-0.	-0.	-0.	-0.	-0.	-0.	-0.

DAM DATA

TOPEL	COOD	EXPD	DAMWID
875.5	2.6	1.5	-0.

PEAK OUTFLOW IS 25. AT TIME 44.50 HOURS

PEAK OUTFLOW IS 33. AT TIME 44.50 HOURS

PEAK OUTFLOW IS 44. AT TIME 44.33 HOURS

PEAK OUTFLOW IS 54. AT TIME 44.17 HOURS

PEAK OUTFLOW IS 70. AT TIME 44.00 HOURS

PEAK OUTFLOW IS 122. AT TIME 43.50 HOURS

PEAK OUTFLOW IS 185. AT TIME 43.17 HOURS

PEAK OUTFLOW IS 247. AT TIME 42.67 HOURS

Input Data
Equivalent PMF Analysis
Potosi Lake Dam
MO. ID. No. 30477
BIO

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS							
				RATIO 1 .05	RATIO 2 .06	RATIO 3 .07	RATIO 4 .08	RATIO 5 .09	RATIO 6 .10	RATIO 7 .11	RATIO 8 .12
HYDROGRAPH AT	O-IN	.86	1	188.	226.	264.	301.	339.	377.	414.	452.
		(2.22)	(	5.34)(	6.40)(	7.47)(	8.54)(	9.60)(	10.67)(	11.74)(	12.80)(
ROUTED TO	DAM	.86	1	25.	33.	44.	54.	70.	122.	185.	247.
		(2.22)	(	.70)(	.93)(	1.23)(	1.53)(	1.98)(	3.46)(	5.23)(	7.01)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	872.00	872.00	875.50
STORAGE	438.	438.	544.
OUTFLOW	0.	0.	59.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.05	874.21	0.	503.	25.	0.	44.50	0.
.06	874.60	0.	516.	33.	0.	44.50	0.
.07	874.98	0.	527.	44.	0.	44.33	0.
.08	875.34	0.	539.	54.	0.	44.17	0.
.09	875.68	.18	550.	70.	3.50	44.00	0.
.10	875.90	.40	558.	122.	5.17	43.50	0.
.11	876.05	.55	562.	185.	6.17	43.17	0.
.12	876.15	.65	566.	247.	6.67	42.67	0.

Output Summary
Equivalent PMF Analysis
Potosi Lake Dam
MO. ID. No. 30477
Bll